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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/997,190	11/20/2001	Richard H. Blunk	GP-301597	4053

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EXAMINER	
YUAN, DAH WEI D	
ART UNIT	PAPER NUMBER
1745	

DATE MAILED: 07/17/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/997,190	BLUNK ET AL.	
	Examiner	Art Unit	
	Dah-Wei D. Yuan	1745	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *14 May 2003* .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-30* is/are pending in the application.

4a) Of the above claim(s) *12-30* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-4,6-8 and 11* is/are rejected.

7)☒ Claim(s) *5,9 and 10* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *20 November 2001* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

LOW CONTACT RESISTANCE PEM FUEL CELL

Examiner: Yuan S.N. 09/997,190 Art Unit: 1745 July 10, 2003

Election/Restrictions

1. Applicant's election with traverse of Group I-1, claims 1-11, in Paper No. 5 is acknowledged. The traversal is on the ground(s) that claim 1 is generic to all of the other product claims 2-18. This is not found persuasive because the three species in Group I, claims 1-11, 12-14, 15-18, all have distinct feature and structure, i.e., species I-1 requires the filler resides at the interface between the surface layer and the composite, species I-2 requires the electrically conductive particle adhering to the surface of the composite; species I-3 requires the conductive film on the surface of the polymer composite to be continuous. The election requirement to elect a single disclosed species for prosecution is deem proper and is therefore made FINAL. Claims 12-30 are withdrawn from consideration.

Claim Objections

2. Claims 1-11 are objected to because of the following informalities:

The definition of the term "PEM" in claim 1 is imprecise. It is suggested to define the term "PEM" in the claim, rather than using acronym.

The meaning of the term "fibrillose" in claim 6 is unclear and cannot be found in the Merriam-Webster Dictionary. However, the term is interpreted as "fiber-like material" based on the context in the instant specification.

Appropriate corrections are required.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. Claims 1-4,6,11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Cisar et al. (US 6,562,507) in view of Braun et al. (US 2002/0039675 A1).

With respect to claims 1 and 4, Cisar et al. teach a polymer electrolyte membrane (PEM) fuel cell comprising a polymer electrolyte membrane (106), ink type electrodes (108,109) formed onto the membrane, and porous gas diffusion layers (109) formed onto the electrodes. See Figure 13. The gas diffusion layer further comprises a gas diffusion matrix and a metal current collector disposed within the gas diffusion matrix, wherein the gas diffusion matrix comprises a conductive carbon fiber, conductive carbon powder and a hydrophobic bonding material. The current collector is made by a sintered metal, such as titanium. A light coating of noble metal on the porous titanium sheets insures a long service life and stable operation even in a very corrosive environment. Gold plated stocks function well as current collectors against electrocatalyst ink decals on the fuel cell stack because of its good oxidation resistance and acid resistance. The conductivity of gold is greater than that of the titanium substrate. See Column 5, Lines 13-22; Column 6, Lines 54-65; Column 8, Line 46 to Column 9, Line 13.

However, Cisar et al. do not teach the use of a polymer composite as the substrate for the current collector. Braun et al. teach the use of a highly conductive polymer composite as the

current collector in a solid polymer electrolyte membrane (PEM) type fuel cell system. They use an electrically conductive polymer composite structure in highly-corrosive environments, wherein the electrically conductivity of the resulting structure is improved as a result of enhanced filler loading capacity of the composition. Specifically, the polymer resin is combined with highly conductive filler particles. Preferably, the filler particles comprise carbon and/or graphite. The preferred composition of the polymer composite contains 45-95 wt% graphite powder, 5-50 wt% polymer resin, and 0-20 wt% metallic fiber, carbon fiber and/or carbon nanofiber. See Paragraphs 9, 20,23,27. Therefore, it would have been obvious to one of ordinary skill in the art to use the conductive polymer composite as the substrate of the current collector on the fuel cell of Cisar, because Braun et al. teach the polymer composites exhibit good corrosion resistance and electrical conductivity in a highly-corrosive environment. Moreover, it is the position of the examiner that the filler particles (graphite) would inherently reside at the interface between the coating and the polymer composite substrate, given the high concentration of the graphite filler particles (45-95 wt%) in the composite. *A reference which is silent about a claimed invention's features is inherently anticipatory if the missing feature is necessarily present in that which is described in the reference.* In re Robertson, 49 USPQ2d 1949 (1999).

With respect to claim 2, the filler particle comprises carbon and graphite. See Paragraph 23. Therefore, it would have been obvious to one of ordinary skill in the art to use the conductive polymer composite, which has carbon and/or graphite as the filler material, as the substrate of the current collector on the fuel cell of Cisar, because Braun et al. teach the polymer

composites exhibit good corrosion resistance and electrical conductivity in a highly-corrosive environment.

With respect to claim 3, Braun et al. teach the filler may be provided in various forms, including particles, fibers, flakes and spheres. See Paragraph 24. Therefore, it would have been obvious to one of ordinary skill in the art to use the conductive polymer composite, which has carbon and/or graphite particles as the filler material, as the substrate of the current collector on the fuel cell of Cisar, because Braun et al. teach the polymer composites exhibit good corrosion resistance and electrical conductivity in a highly-corrosive environment.

With respect to claim 6, Braun et al. teach the filler may be provided in various forms, including particles, fibers, flakes and spheres. The electrical current would flow along the general direction of the fiber-like material due to the high volume content of the filler material. See Paragraphs 24,27. Therefore, it would have been obvious to one of ordinary skill in the art to use the conductive polymer composite, which has graphite fiber as the filler material, as the substrate of the current collector on the fuel cell of Cisar, because Braun et al. teach the polymer composites exhibit good corrosion resistance and electrical conductivity in a highly-corrosive environment.

With respect to claim 11, Braun et al. teach the polymer is chosen from the group comprising polyester, phenolic and epoxy-containing resin. See Paragraph 14. Therefore, it would have been obvious to one of ordinary skill in the art to use the conductive polymer composite, which is chosen from the group comprising polyester, phenolic and epoxy-containing resin, as the substrate of the current collector on the fuel cell of Cisar, because Braun et al. teach

the polymer composites exhibit good corrosion resistance and electrical conductivity in a highly-corrosive environment.

5. Claims 1-4,6-8,11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Cisar et al. (US 6,562,507) in view of Bisaria et al. (US 6,379,795 B1).

With respect to claims 1 and 4, Cisar et al. teach a polymer electrolyte membrane (PEM) fuel cell comprising a polymer electrolyte membrane (106), ink type electrodes (108,109) formed onto the membrane, and porous gas diffusion layers (109) formed onto the electrodes. See Figure 13. The gas diffusion layer further comprises a gas diffusion matrix and a metal current collector disposed within the gas diffusion matrix, wherein the gas diffusion matrix comprises a conductive carbon fiber, conductive carbon powder and a hydrophobic bonding material. The current collector is made by a sintered metal, such as titanium. A light coating of noble metal on the porous titanium sheets insures a long service life and stable operation even in a very corrosive environment. Gold plated stocks function well as current collectors against electrocatalyst ink decals on the fuel cell stack because of its good oxidation resistance and acid resistance. The conductivity of gold is greater than that of the titanium substrate. See Column 5, Lines 13-22; Column 6, Lines 54-65; Column 8, Line 46 to Column 9, Line 13.

However, Cisar et al. do not teach the use of a polymer composite as the substrate for the current collector. Bisaria et al. teach the use of an injection molded composition having excellent strength and stiffness as current collectors in the fuel cells. In one embodiment, the material is a thermoplastic liquid crystalline polymer resin combined with a conductive graphite

filler. The conductive graphite filler is present in the composition at concentrations in the range of about 5 to 80%. See Column 4, Lines 37-51; Column 7, Lines 28-52. Therefore, it would have been obvious to one of ordinary skill in the art to use the conductive polymer composite as the substrate of the current collector on the fuel cell of Cisar, because Bisaria et al. teach the polymer composites exhibit excellent strength and stiffness as current collectors in the fuel cells. Moreover, it is the position of the examiner that the filler particles (graphite) would inherently reside at the interface between the coating and the polymer composite substrate, given the high concentration of the graphite filler particles (5-80 wt%) in the composite. *A reference which is silent about a claimed invention's features is inherently anticipatory if the missing feature is necessarily present in that which is described in the reference.* In re Robertson, 49 USPQ2d 1949 (1999).

With respect to claim 2, the filler particle comprises graphite powder and graphite fiber. See Column 7, Lines 43-52. Therefore, it would have been obvious to one of ordinary skill in the art to use the conductive polymer composite, which contains graphite powder/fiber as the filler material, as the substrate of the current collector on the fuel cell of Cisar, because Bisaria et al. teach the polymer composites exhibit excellent strength and stiffness as current collectors in the fuel cells.

With respect to claim 3, Bisaria et al. teach the use of graphite powder in the polymer composite. See Column 7, Lines 43-52. Therefore, it would have been obvious to one of ordinary skill in the art to use the conductive polymer composite, which contains graphite particles as the filler material, as the substrate of the current collector on the fuel cell of Cisar,

because Bisaria et al. teach the polymer composites exhibit excellent strength and stiffness as current collectors in the fuel cells.

With respect to claim 6, Bisaria et al. teach the use of nickel-coated graphite fiber in the polymer composite. See Column 6, Lines 18-21. Therefore, it would have been obvious to one of ordinary skill in the art to use the conductive polymer composite, which contains nickel-coated graphite fibers as the filler material, as the substrate of the current collector on the fuel cell of Cisar, because Bisaria et al. teach the polymer composites exhibit excellent strength and stiffness as current collectors in the fuel cells.

With respect to claim 7, Bisaria et al. teach the filler material can be graphite fibers in length of 0.25" to 0.5". The thickness of the current collector is about 1 to about 3 mm (0.04-0.12 inch). As a result, there would be continuous fibers that extend through the thickness of the polymer composite. See Column 9, Lines 27-30, Column 10, Lines 1-6. Therefore, it would have been obvious to one of ordinary skill in the art to use the conductive polymer composite, which contains continuous fibers extending through the thickness of the composite, as the substrate of the current collector on the fuel cell of Cisar, because Bisaria et al. teach the polymer composites exhibit excellent strength and stiffness as current collectors in the fuel cells.

With respect to claim 8, Bisaria et al. teach the polymer composite as describe above can be used as current collector, flow field plate or bipolar plates in a fuel cell system. See Figure 1; Column 1, Lines 26-43. Therefore, it would have been obvious to one of ordinary skill in the art to use the conductive polymer composite as a bipolar plate on the fuel cell of Cisar, because

Bisaria et al. teach the polymer composites can be used as either a current collector or a bipolar plate in the fuel cell system.

With respect to claim 11, Bisaria et al. teach the polymer is chosen from the group comprising polyester and poly(ester-amides). See Column 5, Line 54 to Column 6, Line 10. Therefore, it would have been obvious to one of ordinary skill in the art to use the conductive polymer composite, which is chosen from the group comprising polyester and poly(ester-amides), as the substrate of the current collector on the fuel cell of Cisar, because Bisaria et al. teach the polymer composites exhibit good corrosion resistance and electrical conductivity in a highly-corrosive environment.

Allowable Subject Matter

6. Claims 5,9,10 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. Claims 5,9,10 would be allowable because the prior art does not disclose or suggest the current collector comprises a metal substrate having a coating of the composite thereon.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Dah-Wei D. Yuan whose telephone number is (703) 308-0766. The examiner can normally be reached on Monday-Friday (8:00-5:00).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Patrick J. Ryan, can be reached on (703) 308-2383. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 872-9310 for regular communications and (703) 872-9311 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0661.

Dah-Wei D. Yuan
July 14, 2003